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FOREST PEST MANAGEMENT
Pacific Southwest Region

Report No. 81-1

3430 Evaluation
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CHARLTON-CHILAO RECREATION AREA EVALUATION, ANGELES NATIONAL FOREST

John Kliejunas, Plant Pathologist
Gregg DeNitto, Plant Pathologist
John Pierce, Entomologist

PSW FOREST AND RANGE EXPERIMENT STATION
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ABSTRACT

The Chilao Ranger Station, Charlton Flat Picnic Area, and Chilao, Horse Flats, and Bandito Campgrounds on the Arroyo Seco Ranger District were evaluated to develop and suggest alternative suppression-prevention methods which could be programmed into the vegetative management plan for the Recreation Area. The major disease problems were western dwarf mistletoe on Jeffrey and Coulter pines in parts of the Chilao Campground and Ranger Station, and annosus root disease in Chilao, Charlton Flat and Horse Flats. The Jeffrey pine beetle, western pine beetle and California flatheaded borer were present at low levels. Management options for reducing the impact of dwarf mistletoe -- including broom pruning, removal of infected overstory trees and thinning — for reducing the impact of annosus root disease, and for integration of treatments are presented. Locations of problems are indicated in diagrams attached to the report.

INTRODUCTION

On December 1-5, 1980, John Kliejunas, Gregg DeNitto (pathologists), and John Pierce (entomologist) of the Forest Pest Management Staff evaluated the Charlton-Chilao Recreation Area -- including Chilao Campground, Chilao Ranger Station, Charlton Flat Picnic Area, the Horse Flats Campground and the Bandito Campground -- on the Arroyo Seco Ranger District. They were accompanied during part of the evaluation by Al Wright, Bruce Quintelier, and Jim Thomas.

The objective of the evaluation was to suggest alternative suppression-prevention methods which could be programmed into the vegetative management plan for the Recreation Area. Particular interest was expressed in options available for controlling dwarf mistletoe and annosus root disease.

USDA, FOREST SERVICE, PACIFIC SOUTHWEST REGION
State and Private Forestry, Forest Pest Management
630 Sansome Street, San Francisco, California 94111

OBSERVATIONS

The stands examined were predominantly Jeffrey pine, with occasional ponderosa, knobcone, Coulter, and sugar pine, incense-cedar, bigcone Douglas-fir, and canyon live oak. Exotic pines, incense-cedar, giant sequoia, and juniper were planted in some areas.

CHILAO CAMPGROUND

Western Dwarf Mistletoe. Western dwarf mistletoe, Arceuthobium campylopodum, was infecting Jeffrey, ponderosa, knobcone, and Coulter pines at various locations in the campground (see attached Chilao Campground map). Infections were most numerous in the Upper Chilao area of the campground, where Jeffrey and knobcone pines had moderate to severe infections. A large portion of these infected trees, especially those in the vicinity of the new visitor center parking lot (parking area 2), had witches brooms in the lower and mid-crowns. Pines in the southern part of Upper Chilao, from the Angeles Crest Highway to parking area 4, were generally infested. One discrete area of dwarf mistletoe infestation occurred south of parking area 5, where a dense understory of Jeffrey pine was being infected from one overstory tree.

Two discrete areas of dwarf mistletoe infestation were noted in the Lower Chilao area. One infected overstory tree, south of parking area 9, was a source of inoculum for naturally-occurring and recently planted pines in the understory. Trees in the vicinity of parking area 12 had numerous brooms.

Other areas of dwarf mistletoe infestation were: 1) in the vicinity of parking areas 13 and 14, 2) northwest of parking area 15, 3) one Coulter pine west across the road from parking area 20, and 4) two areas along the main campground road between the Angeles Crest Highway and Manzanita Drive.

Annosus Root Disease. Four annosus root disease centers were found at Chilao (see Chilao Campground map). Confirmation was based on the presence of Fomes annosus conks within stumps or incubation of collected wood samples in the laboratory.

At center #1, east of parking area 2, seven pine stumps south and upslope from the road were present; conks were found in three of the stumps. At center #2, southwest of the intersection of the main campground road and the Angeles Crest Highway, conks were present in three stumps in a fairly open area; however, incense-cedar and smaller pines in the vicinity exhibited no above ground symptoms of infection. Center #3 was not as discrete; the hillside south of parking area 3, including the proposed snow play area, had little coniferous vegetation with numerous pine and incense-cedar stumps. One living pine and one living incense-cedar were thin-crowned with off-color foliage. Fomes annosus conks were found in two pine stumps and the fungus was present in resin-soaked wood taken from one dead incense-cedar sapling. At center #4, a conk was present in one pine stump.

A fading pine ten feet from the stump was infested by the California flatheaded borer (Melanophila californica), and was also probably infected with F. annosus. A pine with a broken stem was between the infected stump and the dying tree.

Other Problems. The Jeffrey pine beetle, Dendroctonus jeffreyi, was detected in one overstory Jeffrey pine near the proposed visitor center. Five Coulter pines with fading crowns north of parking areas 18 and 19 were killed by the western pine beetle, D. brevicomis, and the flatheaded borer. One of the five was also attacked by the red turpentine beetle, D. valens.

Moderate to severe oxidant air pollutant (ozone) damage was observed on Jeffrey pines in the vicinity of the Upper Chilao Campground. Scattered incense-cedars in the same area were infected by true mistletoe, Phoradendron juniperium subsp. libocedri. Canyon live oak at two locations -- the gate to Upper Chilao and near parking area 15 -- were infected by another species of true mistletoe, P. villosum subsp. villosum.

CHILAO RANGER STATION

Numerous pines, mostly Coulter, were infected by western dwarf mistletoe. Their general locations are indicated on the enclosed sketch map of the station.

Root diseases or other problems were not noted in the vicinity of the ranger station.

CHARLTON FLAT PICNIC AREA

Western Dwarf Mistletoe. Western dwarf mistletoe was found at three discrete locations at Charlton Flat (see attached Charlton Flat map). One Coulter pine, north and across the road from the parking area 2, had a single witches broom eight feet from the ground. Approximately 15 mature overstory ponderosa pines in the vicinity of parking area 3 were lightly to moderately infected, and some had large brooms. A group of five Coulter pines along the road to Vetter Lookout were infected.

Annosus Root Disease. Two annosus root disease centers were found. One large center extended from the vicinity of parking area 1 to parking area 2 on both sides of the road. Numerous old pine stumps were present in this area and F. annosus conks were found in four of these. Center #2 was an opening west of center #1 and on the north side of the road; it contained 6 old stumps and conks were found in one of these.

Other Problems. Armillaria mellea was detected in one ponderosa pine stump on the margin of the dwarf mistletoe infection center just west of parking area 4. Western pine beetle attacks were found on two overmature ponderosa pines at the western margin of annosus center #1, and on two declining ponderosa pines uphill. Further uphill, two dead ponderosa pines with inactive western pine beetle attacks were found in an area with approximately 10 old stumps. Fomes annosus was not recovered from these stumps.

No insect or disease problems were noted in the proposed Memorial or Mt. Mooney picnic areas across the Angeles Crest Highway from Charlton Flat.

HORSE FLATS

Western Dwarf Mistletoe. Two discrete centers of western dwarf mistletoe were found. One was located near the entrance to the campground, and the other was in the vicinity of parking area 8. Both of these were minor infestations having minimal impact on the trees at present.

Annosus Root Disease. Six annosus root disease centers were found at Horse Flats (see attached map of Horse Flats). All six centers had fading Jeffrey pines within or at the margins, indicating that the centers were active and enlarging.

BANDITO CAMPGROUND

Dwarf mistletoe was found on only one tree, a Jeffrey pine near the entrance to the campground. The infections were in the lower crown and were causing witches broom formation.

Fomes annosus was not found in approximately 20 stumps checked in the campground. Planted incense-cedar, giant sequoia, and Coulter pines in the vicinity of the stumps appeared healthy.

An unknown needle disease was present on two Coulter pines near the center of the campground. The disease was affecting only a few branches on the trees and was not causing significant damage.

BIOLOGY OF PEST ORGANISMS

WESTERN DWARF MISTLETOE

Western dwarf mistletoe, Arceuthobium campylopodum, infects Jeffrey, ponderosa, knobcone, and Coulter pines. Other conifers or hardwoods are not infected by this particular species. Dwarf mistletoes are obligate parasites that are completely dependent on their host for support, water, and most of their mineral and organic nutrients. They often cause the formation of "witches brooms", or dense masses of distorted branches, on the host that divert nutrients from the rest of the tree. Infection can cause growth reduction, abnormalities, mortality and predisposition to attack by other pests. In particular, infected trees appear to be more susceptible to attack by bark beetles and the California flatheaded borer. The dwarf mistletoe/bark beetle complex is responsible for 40 to 60% of the pine mortality in southern California during years of normal precipitation. Mortality is more severe when other stress factors occur, such as drought, poor site, or competition in overstocked stands.

Dwarf mistletoe spreads between trees and within crowns of trees by means of small seeds that are forcibly ejected into the air. Spread from overstory to understory is limited to the distance the seeds are shot - generally 20 to 60 feet, but as much as 100 feet if assisted by wind or on steep slopes. Dwarf mistletoe spreads upward in pine at an average rate of 4 inches per year.

ANNOSUS ROOT DISEASE

Fomes annosus is a fungus that attacks a wide range of woody plants, causing a decay of the roots and butt and the death of sapwood and cambium. All conifer species in California are susceptible to the fungus. Hardwood species are rarely damaged or killed. Madrone (Arbutus menziesii), and a few brush species (Arctostaphylos spp. and Artemisia tridentata) are occasional hosts.

During favorable periods, the fungus forms fruiting bodies (conks) in decayed stumps, under the bark of dead trees, or in the duff at the root collar. The fungus becomes established in freshly cut stumps from airborne spores produced by conks, and then grows into the root system. The fungus subsequently spreads to healthy roots of surrounding susceptible species via root contacts. Local spread of the disease outward from an infected stump typically results in the formation of a disease center, with stumps and older dead trees near the center and fading trees on the margin. The centers continue enlarging until they reach barriers, such as openings or groups of non-susceptible plants.

The fungus may remain alive for as long as 50 years as a saprophyte in rotting roots and stumps. Young susceptible trees invading the site often die after their roots contact old infected root systems in the soil.

BARK BEETLES

The bark beetles encountered live and breed under the bark of their host trees. Adult beetles bore galleries under the bark in which eggs are deposited by the female beetle. Usually blue stain fungi are carried on the bodies of the invading beetles so the host is also infected by these organisms. The subsequent development of the fungus and young beetle broods usually kills the host.

Prospective host trees can resist bark beetle invasion with pitch and resin which is somewhat toxic to the beetles. Characteristic globs of pitch and boring dust (pitch tubes) are often found on attacked pines because the beetles push this material out of their tunnels as they struggle to overcome the tree's resistance. Healthy trees are able to produce large amounts of pitch to contest beetle entries, but diseased, injured, or drought-stressed trees are more likely to succumb.

Bark beetles attacking a tree produce attractants (pheromones) that aggregate many hundreds of beetles to the same spot. If bark beetle populations are large, the resistance of almost any host, even a vigorous host, can be overwhelmed and large groups of trees may be killed.

MANAGEMENT OPTIONS

1. No change in present management. Dwarf mistletoe infection levels are high in parts of Chilao Campground. If nothing is done to control this disease it will increase in intensity in trees already infected and spread to surrounding susceptible trees. Severely infected trees have a high probability of dying in 10 to 15 years.

   Fomes annosus in Chilao, Charlton Flat and Horse Flats will persist in the infected stumps and roots until the wood is completely rotted. Host trees on the edge of active annosus centers will become infected and die, probably as a result of bark beetle attacks. Conifers planted in disease centers will die as their roots encounter old infected roots and stumps and the fungus may be perpetuated in the area.

   Trees under stress in the campground areas may serve as brood trees for bark beetles. This may result in increased numbers of bark beetles that can attack surrounding "healthy" trees. In addition to dwarf mistletoe and root disease, trees may be periodically stressed during drought, especially in unmanaged stands.

2. Reduce impact of dwarf mistletoe. Several alternatives for reducing the impact of dwarf mistletoe in recreational sites are available. FPM funding is available for approved dwarf mistletoe control projects when K-V and P&M funds do not exist.

   a. Pruning of witches brooms. Chilao Campground, Chilao Ranger Station and possibly Charlton Flat have trees which would benefit from broom pruning. The objective of broom pruning is to increase a trees's vigor, and therefore to prolong its life, by removing a source of nutrient and moisture drain. High-value trees can be pruned of brooms in the lower crown if, after removal of the brooms, the tree will still have a live crown ratio of 30% or more. When pruning, all broomed branches should be cut flush with the bole. It should be kept in mind that broom pruning of trees in active annosus centers may be fruitless because the trees could die from root rot and subsequent bark beetle attacks.

      Green pine slash caused by broom pruning should be treated so as to reduce the risk of pine engraver (Ips spp.) buildup. Slash created in the spring or early summer should be lopped and scattered, piled and burned, or removed from the site.

   b. Remove infected overstory trees to protect regeneration. If the objective is to save understory trees, the infected overstory trees should be removed to eliminate the source of inoculum. The understory should then be thinned and pruned to eliminate dwarf mistletoe infections. Areas at Chilao where overstory removal may be preferred over broom pruning include the area south of parking area

9 where one infected overstory tree is present and regeneration is still uninfected, and south of parking area 5 where one overstory tree is a source of inoculum for the Jeffrey pine understory.

c. Thinning. Thinning of infected stands will aid in maintaining optimum growth of residuals and reduce stress. For example, the infected pole-size Knobcone pines immediately southwest of the proposed visitor center would benefit from sanitation thinning. Following release, lightly infected residuals may vertically outgrow the dwarf mistletoe. Noninfected trees should be favored as leave trees. The removal of all trees with 6-class dwarf mistletoe ratings of 5 and 6 should be considered because these trees have a high probability of dying in the next 10 to 15 years. Treat all freshly cut stumps with borax to prevent invasion by F. annosus.

3. Reduce impact of Fomes annosus. Once annosus root disease is established in a stand, no direct control is available. Control, therefore, involves prevention of new centers by decreasing the risk of stump infection, and silvicultural manipulation of infected stands to minimize the effects of the disease. The following alternatives are available:

a. Prevent stump infections. Application of granular borax to freshly cut coniferous stumps is effective (90%) in preventing new infections. The chemical is toxic to the spores of F. annosus, but has no effect on existing infections. Borax application is required on all coniferous stumps cut in and near developed recreation sites (FSM R-5 Supp. 2305 and 2331.33). Application requires the prior submission of a Pesticide Use Proposal.

b. Plant hardwoods. Revegetation of active annosus centers should be done only with resistant species. All conifers are susceptible to the disease. Leaving the centers barren or revegetating with resistant hardwoods will allow the fungus to eventually die out so that conifers can again be regenerated. Unfortunately, this may take up to 50 or more years.

Favoring hardwoods already present and planting suitable hardwoods will provide shade as well as establish a barrier of non-susceptible roots that may limit the spread of infection centers.

c. Stump and root removal. Removal of as much infected material as possible may disrupt the underground network for fungal spread and establish a barrier to further spread. After the fine roots that remain in the soil have completely decomposed, the site will be suitable for conifer regeneration. Recently cut stumps within a disease center, both infected and uninfected, could be removed by excavation with a backhoe or by hand. Although removal of infected material from the ground may be effective in reducing the amount of time before conifers can again be planted on the site, its efficacy has not been tested under Southern California conditions.

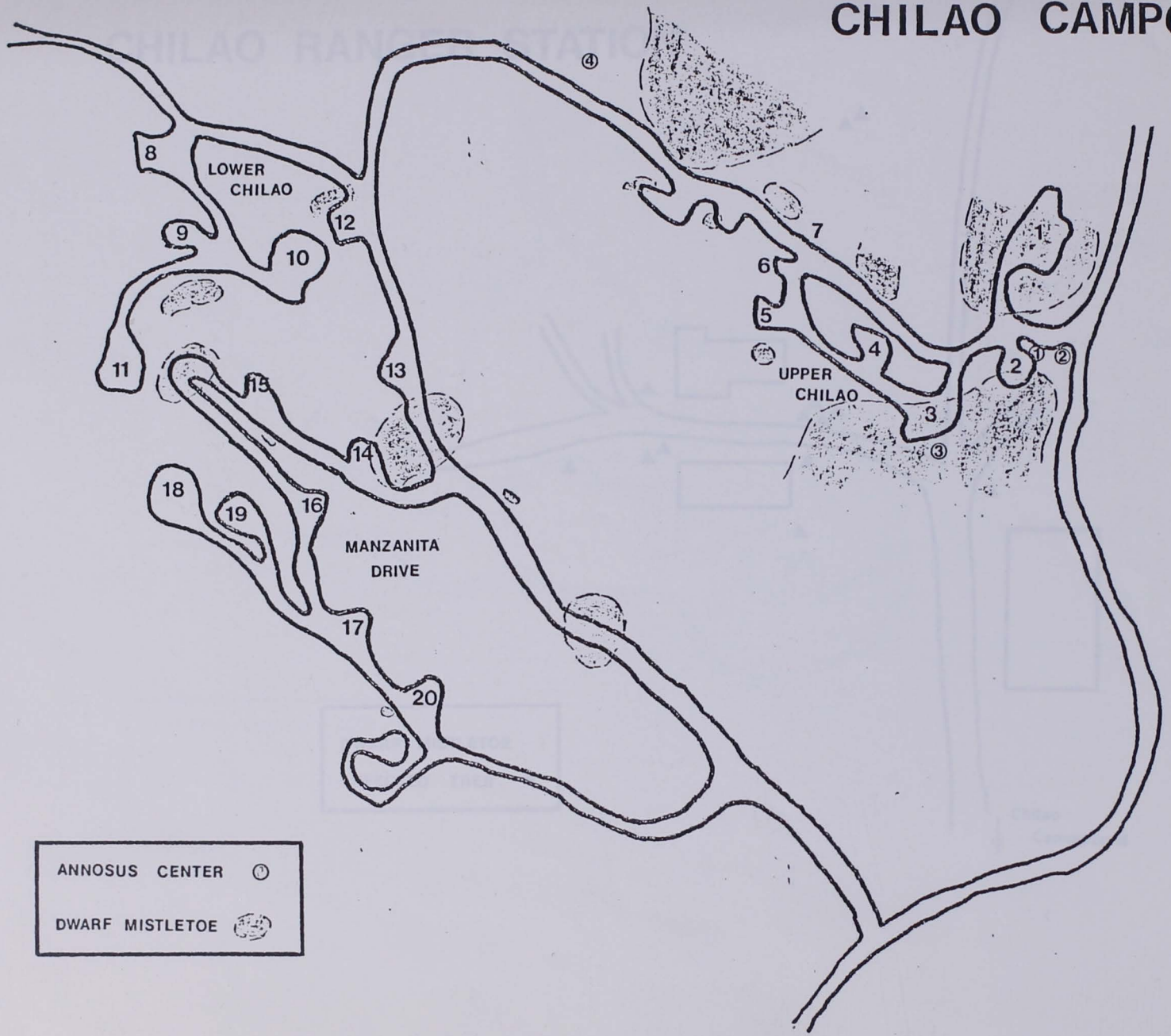
4. Hazard tree removal. Prompt removal of dead and dying trees infested with bark beetles (and the California flatheaded borer) will remove beetles from the area as well as remove eventual hazard trees. In practice it is easier to do this clean-up work during the winter when the beetles are confined to infested trees for long periods, allowing more time for spotting and removal.

5. Integrate Treatments. Management alternatives 2, 3, and 4 are not mutually exclusive; they can be used alone or in combination in various parts of the Charlton-Chilao Recreation Area to produce the desired results. Considerations of the interactions among all insect and disease problems present will result in a successful integration of pest management strategies.

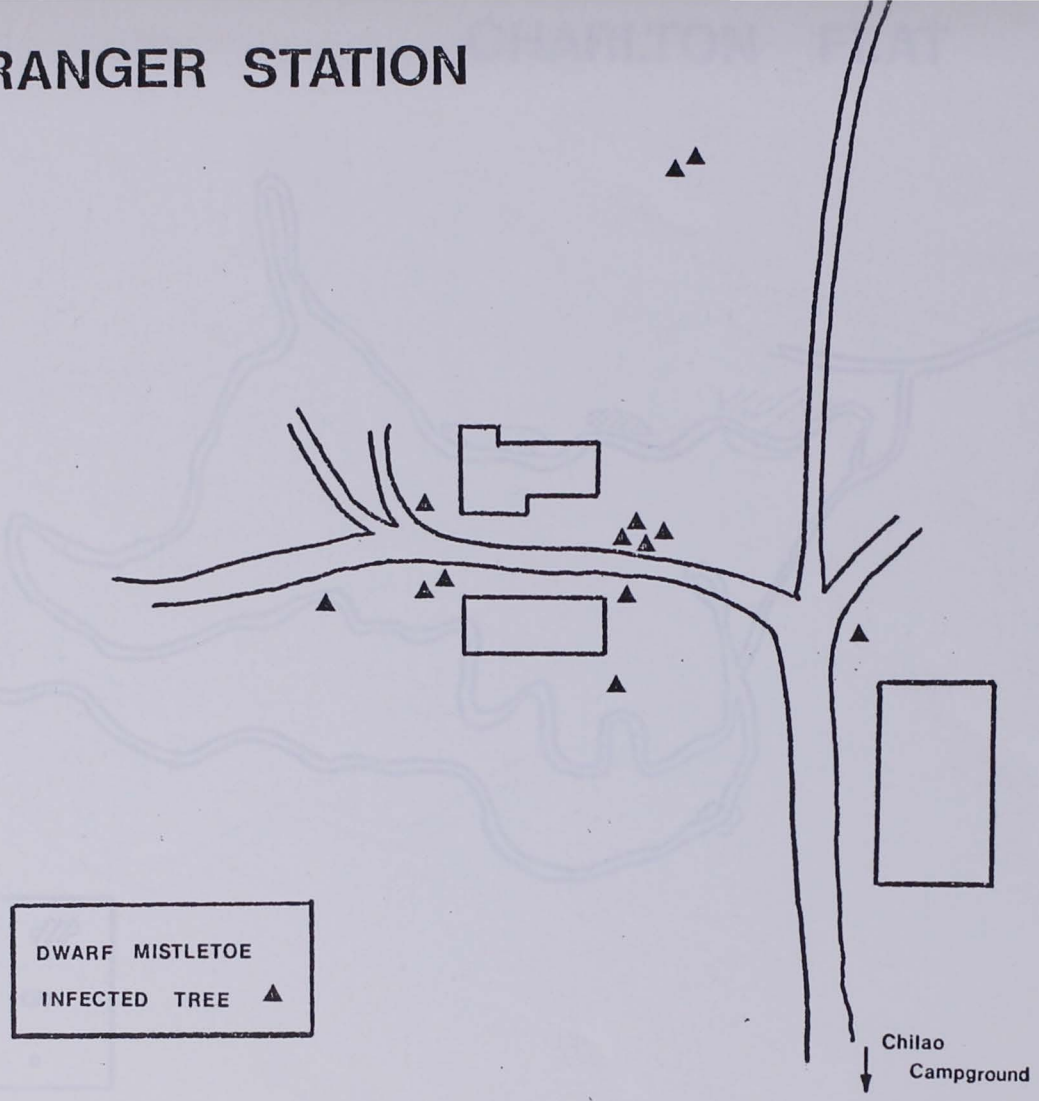
   The objective of any pest management activity in the Recreation Area should be to promote the growth of healthy and vigorous, all-aged, mixed species, properly stocked stands. The integration of suppression and prevention methods into the long-term management of the area is necessary to completely fulfill this objective.

Forest Pest Management personnel are available to provide technical assistance both on the ground and in the planning process in order to reduce pest-related losses. This includes assistance with planning dwarf mistletoe suppression projects and applying for funds.

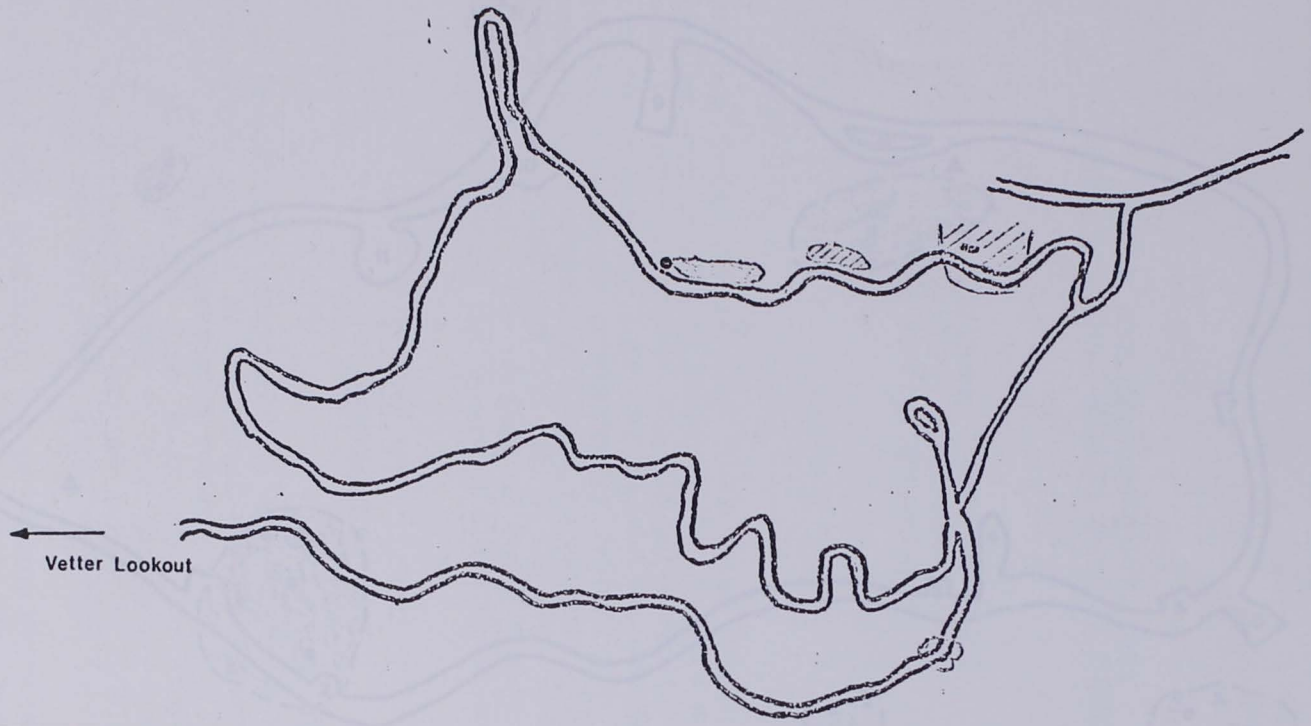
CHILAO CAMPGROUND



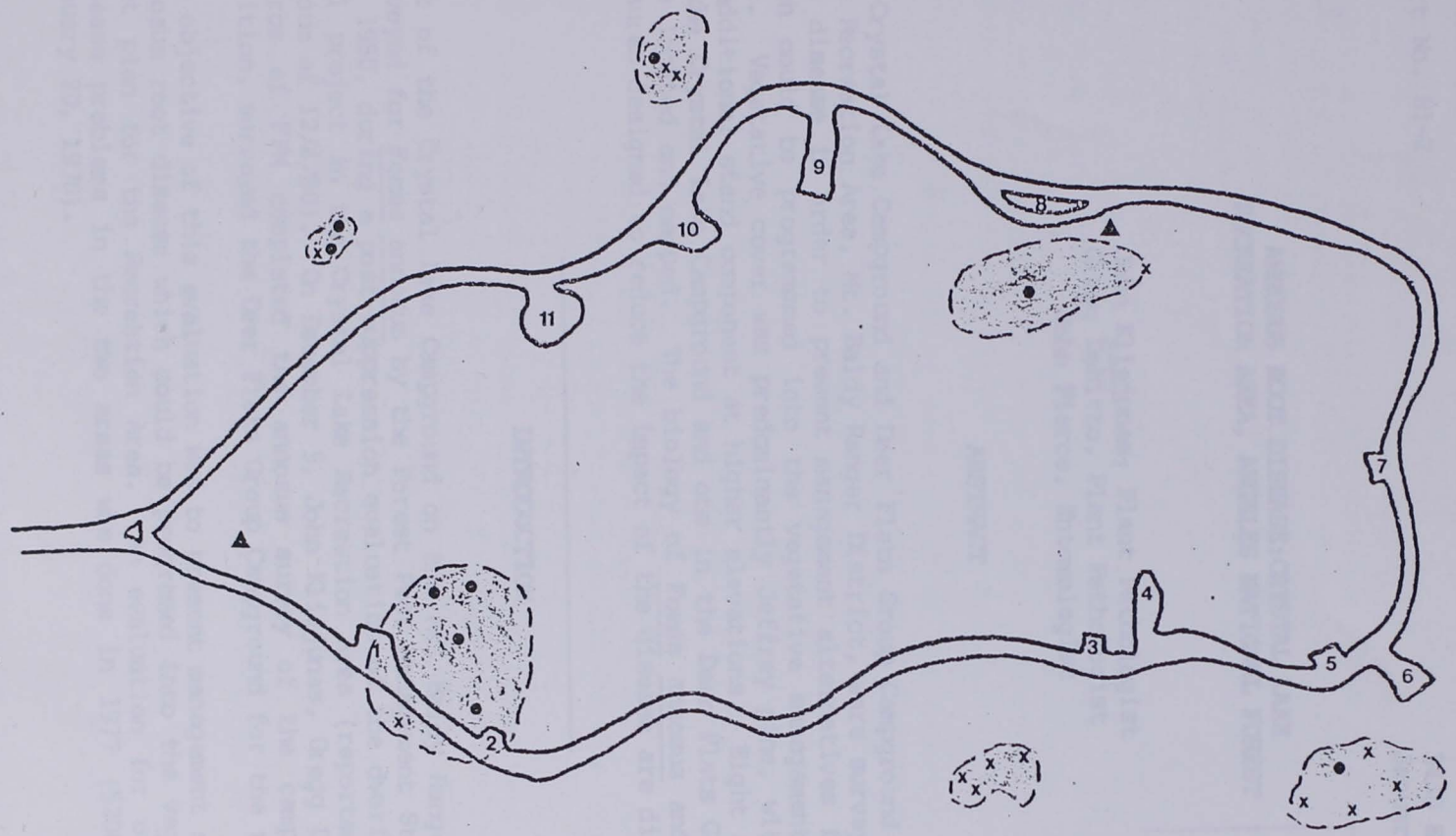
CHILAO RANGER STATION



CHARLTON FLAT



HORSE FLATS



ANNOSUS CENTER	
ANNOSUS STUMP	●
DWARF MISTLETOE	▲
FADING CROWN	x

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